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Original Article

RESOURCE USE EFFICIENCY AND TECHNICAL EFFICIENCY, DETERMINANTS OF TECHNICAL EFFICIENCY IN GROUNDNUT PRODUCTION IN TIRUCHIRAPPALLI DISTRICT- DATA ENVELOPEMENT ANALYSIS (DEA) APPROACH

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ABSTRACT

In the present study, production function and technical efficiency of groundnut cultivation were measured in Tiruchirappalli district of Tamil Nadu. Data Envelopment Analysis was used to evaluate the technical and scale efficiency of the farms in the region of study. A random sampling procedure was used to select 120 sample respondents based on the highest cropping area in the district. Medium farms and large farms showed lower technical efficiency when compared with the small scale farms in the region of study while on the other side, scale efficiency was found higher in the medium and large scale farms. About 27 out of 55 farms on small scale were operating at the optimum level. The average score of technical efficiency was 0.96 in the specification of variable returns. From the Tobit model, the factors influencing labor efficiency and cultivation practices followed by the farmers.

KEYWORDS: DEA, Tobit Model & Resource Use Efficiency

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INTRODUCTION

Groundnut is cultivated in more than 100 countries in the world. Globally, the crop is cultivated in 25.18 million hectares (M ha) with a total production of 41.77 million metric tonnes (MMT) with average productivity of 1600kg per hectare (kg/ha). In 2018-19, the total consumption of groundnut was found to be at 42.72 MMT. The annual global exports and imports of groundnut are 3.39 and 3.12 MMT in 2018-19(USDA, 2019). Around 4 per cent of farmers is directly engaged in groundnut production around the globe, of whom, women laborers account for more than 60 per cent (World Bank Report, 2019). Moreover, supporting labor intensive activities down the value chain, such as transportation (3 per cent), storage, and processing and value addition (19 per cent) remains as an important source of non-farm employment in both formal and informal sectors. The crop generates revenue of about 8000 million US dollars every year. Nearly, 3400 million US dollars have been received from the international trade of groundnut alone (Asian Development Bank, 2019).

Among 10 key producers, large variations exist in yield levels. Yield levels of USA and China are almost three times the world average yield and many major producing countries have yield levels less than the world average (1600 kg/ha). India contributed around 19 percent of world production but the yield level is less than the world average yield and visibly less than that of China and USA, the other two major producers of groundnuts in the world. China has been able to double the yield levels in two decades from 1500 to 3600 kg/ha (between 1980-81 and 2015-16), a factor that has presumably contributed in China's coming out as the largest producer of the world. The highest yield (kg/ha) is recorded in China (3600), USA (3800), Argentina (2190), Vietnam (1860) and Indonesia (1830) (FAO, 2019).

India is the world’s largest producer of pulses, rice, wheat, spices, and spice products. India has many areas to choose for business such as dairy, meat, poultry, fisheries, and food grains, etc. India remains among the top three as far as production of different agricultural crops like paddy, wheat, pulses, groundnut, rapeseeds, natural products, vegetables, sugarcane, tea, jute, cotton, tobacco leaves, etc. Nearly 70 per cent of India’s exports is originated from the agricultural sector. Agricultural products like tea, coffee, sugar, tobacco, spices, cashew-nuts, etc. are the main items of our exports and constitute about 50 per cent of our total exports. Besides manufactured jute, cotton textiles and sugar also contribute another 20 per cent of the total exports of the country (Directorate of Economics and Statistics, 2019).

With its diversified agro-ecology, India is ideally suited for growing major oilseed crops. It accounts for about 13 to 15 per cent of world’s oilseeds area, 8-9 per cent of the world’s oilseeds output and 10-11 per cent of the world’s vegetable oil consumption. Oilseeds contribute about 13-14 per cent of gross cropped area in India and it accounts for nearly 1.4 per cent of national product and 8 per cent of total agricultural consumption (FAO, 2019). About 14 million farmers are engaged in oilseeds production. There are nine oilseed crops grown in the country, of which, seven are of edible oils (soybean, groundnut, rapeseed, mustard, sunflower, sesame, safflower and niger) and two are of non-edible oils (castor and linseed). India holds the first position in the production of most of the minor oilseeds namely, niger, safflower, castor, and sesame. In case of major oilseeds, India ranks first in the production of groundnut, second in rapeseed-mustard and fifth in soybean.

Table 1: Performance of Area, Production, and Productivity of Oilseeds in India

Crops	Growth Rate (Percent)		
	Area	Production	Productivity
Castor	11.10	27.00	16.00
Linseed	-24.60	-7.72	20.80
Sunflower	-29.58	-18.80	15.10
Groundnut	-14.00	-2.44	13.40
Sesame	-7.70	5.00	13.50
Rapeseed-Mustard	0.23	7.40	7.20
Soybean	18.00	6.24	-10.00

Source: (Directorate General of Commercial Intelligence and Statistics, 2019)

METHODOLOGY

Resource Use Efficiency

Production function analysis was used to assess the resource use efficiency in groundnut production. The association between the dependent and independent variables, Cobb- Douglas production function [1] were designated for the study.

The form of regression model used was

$$Y = a\, X_1^{b1}\; X_2^{b2}\; X_3^{b3}\; X_4^{b4}\; X_5^{b5}\; X_6^{b6}\; X_7^{b7} X_8^{b8}\; X_9^{b9} \mu_t$$

Where,

Y	=	Yield of groundnut (kgs /ha)
X_1	=	Quantity of seed material (Kg. /ha.)
X_2	=	Quantity of farmyard manure (T./ha)
X_3	=	Quantity of nitrogen (Kg. /ha.)
X_4	=	Quantity of phosphorous (Kg. /ha.)
X_5	=	Quantity of potash (Kg. /ha.)
X_6	=	Quantity of Gypsum (Kg. /ha.)
X_7	=	Plant protection (litre/ha)
X_8	=	Human labor (man days/ha.)
X_9	=	Machine hours (hrs. /ha.)
μ_t	=	Error term
$a, b_{1,} \ldots b_{10}$	=	Parameters to be estimated

Data Envelopment Analysis

The DEA method [2] is a frontier method that does not involve conditions of a functional form and can house scale issues. “Farrell (1957)” used this method first as a fragment wise linear convex hull approach to frontier estimation. “Later Boles (1966)” and “Afriat (1972)”.“Charnes *et al.* (1978)” created the term “*data envelope analysis”*

The DEA stayed for mutually classic models CRS (constant returns to scale) and VRS (variable returns to scale) with input orientation, where one needs input minimization to obtain a particular product level. Further down the postulation of constant returns to scale, the linear programming model was used for measuring the efficiency of groundnut farms are “(Coelli *et al.*, 1998)”:

$$\text{Min } \theta, \lambda\ \theta$$

$$\text{Subject to } - y_i + Y\lambda \geq 0\ \theta x_i - X\lambda \geq 0$$

$$\lambda \geq 0 \tag{1}$$

Where,

y_i is a vector ($m \times 1$) of groundnut output of the i^{th} groundnut Producing Farms (TPF), x_i is a vector ($k \times 1$) of inputs of the i^{th} TPF, Y is a groundnut output matrix ($n \times m$) for n TPFs, X is the groundnut input matrix ($n \times k$) for n TPFs, θ is the efficiency score. It is a scalar whose value will be the efficiency degree for the i^{th} TPF. If θ =1, TPF will be efficient; otherwise, it will be inefficient,

And

λ is a vector ($n \times 1$) whose values were estimated to get the best results. For an inefficient TPF, the λ values were the weights castoff in the linear combination of other, efficient, TPFs, which impact the projection of the inefficient TPF on the estimated frontier.

The description of constant returns was individually fits when the firms operate at the optimum scale. Or else, the measures of technical efficiency were incorrect for scale efficiency, where it accounts for all the types of returns to production, i.e., increasing, constant and decreasing. So, the CRS model was reformulated by striking a convexity constraint. The measure of technical efficiency was attained in this model with variable returns. Hence, it is named as 'pure technical efficiency'. The following linear programming model estimated it:

Min $\theta, \lambda\ \theta$

Subject to $-y_i + Y\lambda \geq 0$

$\theta x_i - X\lambda \geq 0$

$N_1 \lambda = 1$

$\lambda \geq 0$ (2)

where N_1 is a vector ($n \times 1$) of ones.

When there exist differences amongst the values of efficiency scores in the models CRS and VRS, scale inefficiency is established, representing that the return to scale was variable, i.e. it can be increasing or decreasing. The scale efficiency values for each examined unit can be attained by the ratio between the scores for technical efficiency with constant and variable returns as follows:

$\theta s = \theta CRS\ (XK, YK)/\theta VRS\ (XK, YK)$ (3)

Where,

$\theta_{CRS}(X_K, Y_K)$ = Technical efficiency for the model with constant returns,

$\theta_{VRS}(X_K, Y_K)$ = Technical efficiency for the model with variable returns, and θ_s = Scale efficiency.

It was shown that model (2) makes no difference as to whether TPF is operating in the range of increasing or decreasing returns. The only evidence was the value got by working the scale efficiency in Equation (3) is equal to one, the TPF will be functioning with constant returns to scale. However, when θ_s is smaller than one, increasing or decreasing returns may occur. Hence, to realize the nature of scale inefficiency, it is essential to deliberate another problem of linear programming, i.e. the convexity constraint of the model (2), $N_1\lambda = 1$, is replaced by $N_1\lambda \leq 1$ for the case of non-increasing returns, or by $N_1\lambda \geq 1$, for the model with non-decreasing returns. So, the following models were also aimed at measuring the nature of efficiency.

Non-increasing returns:

Min $\theta, \lambda\ \theta$

Subject to $-y_i + Y\lambda \geq 0\ \ \theta x_i - X\lambda \geq 0$

$N_1 \lambda \leq 1$

$\lambda \geq 0$ (4)

Non-decreasing returns:

Min θ, λ θ

Subject to - $y_i + Y\lambda \geq 0$ $\theta x_i - X\lambda \geq 0$

$N_1 \lambda \geq 1$

$\lambda \geq 0$ (5)

Groundnut production (t/ha) remained as output (Y) in the current study and total male labour (man days), total female labour (women days), seeds/plant population (No.), farmyard manure (t), plant nutrients N (kg), P (kg), K (kg) and Gypsum (kg)distinctly, capital inputs (Rs) on plant protection, other input costs and fixed input costs as inputs (X). The models[2] were solved using the DEAP version 2.1 with input orientation to get the efficiency levels.

Determinants of Technical Efficiency

"Ray (1991) and Worthington and Dollery (1999)", used DEA in estimation of the technical efficiency for the first stage and assessed the determinants of technical efficiency in the second stage mainly the factors contributing.

In the current study, the technical efficiency values attained from the DEA model in view of the CRS input-oriented model were used for evaluating the association between the technical efficiency and factors influencing it. The technical efficiency score from CRS model was selected as the dependent variable for its high accuracy in discriminating efficiency. The descriptive variables comprised of three different types. The variables were (land, labor, and capital), respondent farmers (age and education), and institutional-intervention factors (organizational participation, institutional credit use and technical input). The regression model specified for the present study is given in Equation (6):

Y= a x1 b1 x2 b2 x3b3x4b4 x5 b5 x6b6 U (6)

Where,

Y = Scores of Technical efficiency,

x_1 = Land productivity measured in kg of groundnut produced in one hectare,

x_2 = Labour efficiency measured in terms of total revenue from the groundnut divided by the total labor costs,

x_3 = Capital-use efficiency estimated by dividing total yield with operating expenses,

x_4 = Age of the farmers in years,

x_5 = Dummy to define whether the farmers used institutional credit (1) or not (0), and

x_6 = Dummy to define the frequency of technical visits (1) or not (0).

'a' and 'b_i' are the constant and the coefficient respectively, which were estimated through the ordinary least square analysis after appropriate log conversion.

Tobit Model

The Tobit model is specified as

$$Yi = \beta' X_i + \mu_i, \quad \text{if } \beta' X_i + \mu_i, > 0$$

$$= 0, \quad \beta' X_i + \mu_i, \quad < \tag{7}$$

$i = 1, 2, 3... N$

Where, N denotes the number of observations, Y_i, the dependent variable, X_i, a vector of independent variables, β, a vector of unknown parameters, and μ_i, an independently distributed error term assumed to be normal with zero mean and constant variance σ^2. The method of estimation involved the maximum likelihood method, which takes into account the positive values of Y following the standard normal density function. The zero observations of Y which follows $Y_i < 0$ or $\beta' X_i + \mu_i, < 0$ $\mu i / \sigma$ has a standard normal variate and hence $\mu i / \sigma < -(\beta' X_i) / \sigma$. The probability of this is $F[-(\beta' Xi)/\sigma] = F(Z)$, where F (Z) is the standard normal cumulative distribution function.

The Tobit model employed for the study is

$Y_1 = f$ (LP, LE, CUE, AGE, DV1, DV2) $+\mu_1$

LP = LAND PRODUCTIVITY

LE = LABOUR EFFICIENCY

CUE = CAPITAL USE EFFICIENCY

AGE = AGE OF THE FARMER IN YEARS

DV1 = Dummy variable to describe whether the farmers used institutional credit (1) or not (0),

DV2 = Dummy variable to describe the frequency of technical visits (1) or not (0).

μ_1’ μ_2’ μ_3’ = Random error terms

The Tobit model was analyzed using Gretl Software package.

RESULTS AND DISCUSSIONS

Estimation of Resource Use Efficiency

Estimation of Resource use Efficiency of Groundnut in Small Farms

Cobb-Douglas production [4] was used to estimate the output elasticity with esteem to main inputs in the production of groundnut. The assessed Cobb-Douglas production function for groundnut is fitted out in the table 2.

Table 2: Estimation of Resource Use Efficiency in Small Farms

S. No.	Variables	Regression Coefficient	Standard Error	Significance
1.	Regression constant	1.04	0.55	**
2.	FYM (t/ha)	0.53	0.33	**
3.	Chemical fertilizer (Rs./ha)	0.07	0.02	**
4.	Human labor (man days/ ha)	0.15	1.58	*
5.	Machine hours (hrs./ha)	2.67	8.85	NS
6.	Plant protection chemicals (lit/ha)	0.10	0.09	NS

R^2 = 0.74 F-Ratio =28.75 N = 55

Note

- ** Significant at 1 percent level
- * Significant at 5 percent level
- NS Non-significant

It can be determined from the Table 2 that the coefficient of multiple determination (R^2) was 0.74 indicating that 74 per cent of the systematic variation in groundnut yield could be attributed to the independent variables included in the model. In log-linear production function, the coefficient represents the production elasticity of the resources used. The yield responded significantly to the inputs namely farmyard manure, chemical fertilizers, and human labor. The coefficient of farmyard manure, chemical fertilizers were positive and significant at one per cent level with the coefficient values of 1.04 and 0.53 respectively. Thereby, Human labor was also observed to be positive and significant with coefficient values 0.15 which indicated that an increase in the usage of farmyard manure, and chemical fertilizers by one per cent, **ceteris paribus** would increase the yield of groundnut by 1.04 and 0.53 per cent respectively at the existing geometric mean level. Thus these result indicated that the response was relatively high to the farmyard manure and chemical fertilizers.

The coefficient of human labor remained positive and significant at five per cent level with the coefficient value of 0.15 indicating that one per cent increase in machine hours usage, **ceteris paribus** would increase the yield of groundnut by 0.15 per cent at the existing geometric mean level. The variables machine and plant protection were found to be non-significant.

Estimation of Resource Use Efficiency of Groundnut in Medium & Large Farms

Cobb-Douglas production was used to estimate the output elasticity with esteem to main inputs in the production of groundnut. The assessed Cobb-Douglas production function for groundnut is furnished in Table 3.

Table 3: Estimation of Resource Use Efficiency in Medium and Large Farms

S. No.	Variables	Regression Coefficient	Standard Error	Significance
1.	Regression Constant	2.88	0.749	**
2.	FYM (T/ha)	0.56	0.001	**
3.	Chemical fertilizer (Rs/ha)	0.25	0.004	**
4.	Human Labor (man days/ ha)	0.02	0.68	NS
5.	Machine hours (hrs./ha)	0.09	0.02	**
6.	Plant protection chemicals (lit/ha)	0.14	0.04	**

R^2 = 0.73 F-Ratio = 32.66 N = 65

Note

- ** Significant at 1 percent level
- * Significant at 5 percent level
- NS Non-significant

From the table 3 that the coefficient of multiple determination (R^2) was 0.73 representing that 73 per cent of the systematic variation in groundnut yield could be accredited to the independent variables included in the model. In log-linear production function, the coefficient signifies the production elasticity of the resources used. The yield retorted significantly to the inputs namely farmyard manure, Chemical fertilizers, machine hours and plant protection chemicals.

The coefficient of farmyard manure was positive and significant at one per cent level with the coefficient value of 0.001 respectively, which specified that an increase in the usage of farmyard manure by one per cent, **ceteris paribus** would increase the yield of groundnut by 0.56 per cent at the current geometric mean level separately. Thus these results indicated that the response was relatively high to the farmyard manure.

The coefficient of chemical fertilizers and plant protection chemicals was significant at one per cent level with the coefficient value of 0.25 and 0.14 indicating that one per cent increase in chemical fertilizers and plant protection chemicals usage, **ceteris paribus** would increase the yield of groundnut by 0.25 and 0.14 per cent at the existing geometric mean level respectively. The variable machine hours remained positive and significant at five per cent level with the coefficient value of 0.09 but the variation in existing geometric mean level is not obtained. The variable human labors were found to be non-significant.

Estimation of Technical Efficiency using DEA

Data Envelopment Analysis endeavoured to measure the technical efficiency of Groundnut. The results of DEA, technical and scale efficiencies of groundnut is furnished in the Table 4

The standard used by "Ferreira (2005)" was employed for the current study to choose the deadline score for efficient farms. Farms that functioned at 0.90 or more score were measured as '**efficient farms'**.

Table 4: Efficiency Measures and Descriptive Statistics for Groundnut Producing Farms According to Scale of Operations in the Study Area

Scale of Operation	Efficient Firms (0>0.90)		Efficiency Measures			
	No.	%	Mean	Standard Deviation	Maximum	Minimum
Small Farms						
Technical efficiency (constant returns)	21	38.18	0.92	0.07	1	0.77
Technical efficiency (variable returns)	14	25.45	0.95	0.06	1	0.80
Scale efficiency	27	49.09	0.97	0.04	1	0.78
Medium and Large Farms						
Technical efficiency (constant returns)	26	40.00	0.93	0.07	1	0.59
Technical efficiency (variable returns)	12	18.46	0.96	0.05	1	0.81
Scale efficiency	19	29.23	0.97	0.05	1	0.68
All Farms						
Technical efficiency (constant returns)	51	42.5	0.91	0.07	1	0.73
Technical efficiency (variable returns)	29	24.17	0.94	0.06	1	0.79
Scale efficiency	15	12.50	0.96	0.04	1	0.80

Estimation of Technical Efficiency in Small Farms

From the analysis, it is revealed that about 38.18 per cent of the small farms under the constant returns to scale condition operated with the efficiency level equal to 0.90 or higher. The average efficiency score was 0.92 indicating that 34 farms were not at their efficiency level.

In the specification of variable returns to scale, the influence of production scale on TE was shown. The small

farms showed an increased efficiency and the mean technical efficiency score was raised to 0.97. The improved outcome from variable returns was the inclusion of scale efficiency, while the earlier one didn't take it into account. In the aspect of scale, 27 farms were performing at the best level or were operating near to the best level of efficiency.

Estimation of Technical Efficiency in Medium and Large Farms

In the category of medium and large farms, about 40 per cent of the farmers were assessed to be efficient with scores more than 0.90 while the mean technical efficiency was little higher in the category of 0.93. The mean technical efficiency score remained 0.96 and about 18.46 per cent farms stayed in their best efficiency level.

Regions of Operation in Production Frontier

It is necessary to identify the number of efficient farms, degree of inefficiency and finest scale of operation and to know the distribution of farms in the three regions of production frontier, i.e. under increasing, decreasing or constant returns [3].

Table 5: Distribution of Groundnut Farms in the Study Area Conferring to Categories of Return among Different Scale of Operations

Types of Returns	Small Farms		Medium and Large Farms		All Farms	
	No	%	No	%	No	%
Increasing returns	21	38.18	27	41.54	67	55.83
Constant returns	11	20.00	20	30.77	28	23.33
Decreasing returns	23	41.82	18	27.69	25	20.84

Note: % indicates per cent to the individual category of farms

Further in increasing returns to scale, small farms accounted for 38.18 per cent of the total farms. The production scale of these farms might be amplified by reducing the costs because their performance is observed to be below the optimum production scale. In the region of decreasing returns to scale, small farms were holding their share of 41.81 per cent and can improve their TE by refining production levels. The remaining 20 per cent of the farms were classified under the category of constant returns to scale.

About 42 per cent of the farms were performing in the region of increasing returns to scale and the production can be raised by reducing the costs incurred for cultivating the groundnut crop. Groundnut farms in the medium and large farms category were accounting for 28 per cent and they can upsurge the technical efficiency by dropping down their production levels. About 31 per cent of the farms were performing in the category of constant returns to scale.

Finally, all the farms were grouped together and the analysis was done. The results explored that about 56 per cent of farms were performing on the scale of increasing returns and their scale of production can be raised by dropping the costs incurred for cultivation. Closely, 21 per cent of the groundnut farms were performing the scale of decreasing returns and their technical efficiency can be improved by a decline in their production levels. Furthermore, about 23 per cent of the farms were existing in the category of constant returns to scale.

Technical Efficiency (TE) Determinants in Sample Farms

The result of the estimated Tobit Model was to identify the determinants of technical efficiency in sample farms is well-found.

Table 6: Estimated Tobit Model for the Technical Efficiency Determinants in Sample Farms

Model 1: Tobit, Using Observations 1-120
Dependent Variable: TE Scores
Standard Errors Based on Hessian

Sl. No.	Independent Variables	Co-Efficient	P-value
1	Yield (in Kgs)	**0.00012**	**<0.0001*****
2	Labour Efficiency	**0.08211**	**<0.0001*****
3	Capital Use Efficiency	**3.54508**	**<0.0001*****
4	Age	**-0.00036**	**0.5948** NS
5	Institutional Credit	**0.00751**	**0.3778** NS
6	Technical Visit	**0.00395**	**0.6530** NS
7	Constant	**0.39773**	**<0.0001*****

Note

***** Significant at one per cent level (P<0.01);**

**** Significant at five per cent level (P<0.05);**

NS-Non-Significant

It may perhaps be inferred from the table that Yield from the production of groundnut stood positive and significant at one per cent level with the coefficient value of 0.00012 (P value 0.0001), which specifies that cultivation followed by the study farmers were in a prompt means. The coefficient of Labour efficiency was observed to be 0.08211 (P value < 0.0001). It is detected that the variable is positive and significant at one per cent level.

Further, it can be inferred that the capital efficiency was positive and significant at one per cent level with the coefficient value of 3.54508 (P value<0.0001). The coefficient of age were -0.00036 which is negative and non-significant with the (P-value- 0.5948). The dummy variable Institutional credit was observed to be positive and non-Significant with the co-efficient value 0.00751 and (P-value- 0.3778). Lastly, the dummy variable Technical visit to farms was observed to be positive and non-significant with the coefficient value of 0.00395 and the P-Value was(0.6530).

SUMMARY AND CONCLUSIONS

From the study, we have been estimated the Technical and Scale efficiencies for one of the important oilseeds, viz. Groundnut in Tamil Nadu using data envelopment analysis (DEA). The factors, which influence the technical efficiency of groundnut production, have also been determined using production function analysis.

The study tells us the style of input use in production of groundnut between diverse groups of farmers and has recommended scale impartiality among the farmers. But then again maximum of the inputs have been in a lower proportion than the suggested dosages. This recommends that by application of more inputs there is opportunity to rise the output, production, and efficiency. The category of medium and large scale farmers can experience higher productivity primarily by improved level of inputs usage.

Land and labor factors play a vital role in influencing the technical efficiency in all the farms, and raising the usage of land and labor efficiencies would exhibit increase productivity levels in the cultivation of groundnut crop. Education and Technical support from extension agents were found to have momentous impressions on the technical efficiency levels. In small farms, education and technical support inputs can give an opportunity to raise the productivity levels of groundnut in the area of study. Literacy levels of medium and large scale farmers were meaningfully influencing

the cultivation practices adopted in the region. The credit availability to groundnut farmers was showing an undesirable effect on the technical efficiency to small scale farmers in the area and this requires a comprehensive investigation on outside borrowings in the cultivation of crops in the district.

Even though medium and large farmers had increased productivity and higher technical efficiency connected to physical optimum, the maximum profit per unit of production was reached by the small scale farmers in economic efficiency. As of their rigorous farming in a smaller area, the superiority of groundnuts turned out to be well ensuing in advanced price consciousness. Accordingly, small farmers might be inspired to practice added inputs usage, mainly FYM and also chemical fertilizers, which possibly will move them to advanced level of efficiency of production as per at the moment these farms are functioning at low-input conditions.

Land productivity, Labor efficiency, and Capital Use Efficiency have been found to be contributing with the technical efficiency in groundnut production. Although factors like age, institutional credit, and technical visits were not contributing they must be addressed to make improvement in the crop production.

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